

Anesthesiology experience with patients underwent renal transplantation at a university hospital: first-year results

Anesthesiology experience with patients underwent renal transplantation

Sinan Yılmaz, Kamil Varlık Erel

Department of Anaesthesiology and Reanimation, Aydın Adnan Menderes University School of Medicine, Aydın, Turkey

Abstract

Aim: Renal transplantation (RT) is the most effective treatment modality for end-stage renal disease (ESRD). Transplantation process requires a multidisciplinary (nephrologist, surgeon, anesthetist, pathologist, immunologist, and experienced nurse) approach. This study presents the first-year experience of the anesthesiology department of a university hospital where renal transplantation program just started. **Material and Method:** The digital medical files of 14 patients who underwent renal transplantation due to ESRD between 2017 and 2018 were evaluated retrospectively. The hemodynamic and demographic parameters of all the patients were examined and analyzed. **Results:** Eleven (78.6%) of the donors were provided from deceased and 3 (21.4%) from living individuals. The mean age of all transplantation patients were 39.9 ± 13.3 years (range 21-61). Concerning cause, "unknown etiology" was detected in 8 (57.1%) of the patients. None of the patients experienced difficult intubation. The mean duration of anesthesia was 242.8 ± 85.2 min. Intraoperative hypotension was detected in 6 (42.8%) patients. During the intraoperative period, 1535 ± 771 ml of 0.9% NaCl was administered as the fluid maintenance. Only 2 patients had intraoperative complications. No mortality was observed during the perioperative period. Two of the 14 patients experienced loss of the transplanted kidney. The survival rate of the grafts was 85.8%. **Discussion:** Management of renal transplantation is a serious task which requires teamwork and cooperation as it can favorably change the patient's life quality when implemented successfully. In renal transplantation, achieving the post-transplantation survival rate (90-96%) reported in the literature requires detailed preoperative evaluation of patient along with appropriate intraoperative fluid administration and hemodynamic control.

Keywords

Renal Transplantation; Anesthesia; End-Stage Renal Disease; Survival

DOI: 10.4328/ACAM.6204 Received: 07.02.2019 Accepted: 25.02.2019 Published Online: 01.03.2019 Printed: 01.03.2020 Ann Clin Anal Med 2020;11(2): 150-154

Corresponding Author: Sinan Yılmaz, Department of Anaesthesiology and Reanimation, Adnan Menderes University, School of Medicine, 09100, Aytepe, Aydın, Turkey. T.: +90 2564441256-2109 F.: +90 2562136064 E-Mail: dr_snylmz@hotmail.com

ORCID ID: <https://orcid.org/0000-0002-5281-137X>

Introduction

Renal transplantation (RT) is the most effective treatment modality for end-stage renal disease (ESRD) [1]. The incidence (for 2017, 146 cases per one million population [pmp]) and the prevalence (for 2017, 957 cases pmp) of ESRD requiring renal replacement treatment (RRT) have increased as the average life expectancy has increased in Turkey. The number of patients waiting for organ transplantation is growing day by day [1]. Although the number of renal transplantation has increased in recent years, the number of renal transplantation procedures performed in 2017 (n = 3330) still lags behind the demand in our country. The most important reason for this situation is the lack of the expected increase in cadaver donors [1].

The organ transplantation procedure, which allows the transplantation of the organs taken from the cadaver or live donor to the recipient, requires a multidisciplinary (nephrologist, surgeon, anesthetist, pathologist, immunologist, and experienced nurse) approach [2].

The renovation of renal transplantation, which is the most cost-effective treatment option for patients, is essential for the patients' health and the health expenditures of the country. To increase the number of cadaveric organ donations, the awareness of the whole community on organ donation -particularly the health and educational institutions- should be increased [3]. In this study, we presented the first year experience of the anesthesiology department of a university hospital in which renal transplantation has just started.

Material and Methods

Renal transplantation was first performed on 16 December 2017 at Aydın Adnan Menderes University, Training and Research Hospital. The study was approved by the Local Ethics Committee of the university (Ethics committee decision no: 2018/1508). The digital medical files of 14 patients who underwent renal transplantation due to ESRD between 2017 and 2018 were evaluated retrospectively. The patients' demographic data, concomitant diseases and the source of the transplanted kidney, whether from live donor or cadaver, were noted.

All patients included in the study had been subjected to a comprehensive multidisciplinary evaluation by an anesthesiologist, nephrologist, surgeon and experienced transplantation nurse before the enrollment into the transplantation waiting list.

Informed consent was obtained from all patients prior to the surgery. Electrocardiography (ECG), oxygen saturation (SpO₂) and non-invasive blood pressure and body temperature monitoring were performed after the receiver patients were transferred into the operation room. Hypotension was defined as the systolic arterial blood pressure dropping below 90 mmHg or as a decrease by 20-30% from the baseline [4].

Two (20G) peripheral vascular accesses were opened to the arm without arteriovenous fistula. During the induction of anesthesia, fentanyl 1 mg/kg, propofol 2-2.5 mg/kg, rocuronium bromide 0.6 mg/kg were administered intravenously. For infusion, 10 mg/ml of rocuronium bromide and 0.04 µg/ml of remifentanyl were prepared.

Neuromuscular monitoring was initiated immediately after anesthesia induction before the administration of muscular relaxant. Endotracheal intubation was performed 60-90 seconds after the administration of rocuronium bromide at the intubation dose. During the surgery, rocuronium bromide was administered at a dose of 0.2 mg/kg/h with continuous infusion. From the ventilation parameters, FiO₂ was controlled to maintain

50% and EtCO₂ between 35-40 mmHg. End-tidal desflurane concentration was maintained at 5-6%, and fresh gas flow was applied at a rate of 1.2 lt / min.

Mannitol (30 mg), 81.4±42.5 mg furosemide, and 500 mg methylprednisolone were administered intravenously just after clamp placement. The oblique incision in the lower quadrant revealed the iliac fossa. For postoperative analgesia, morphine was administered intravenously at 0.04 mg/kg dose. Sugammadex 4-8 mg/kg was applied intravenously to the patients just after the end of the surgical operation. The patients were extubated in the operation room.

Statistical Analysis

The appropriateness of the data to the normal distribution was examined with the Kolmogorov- Smirnov test. The correlations between the numerical variables were analyzed using the Pearson or Spearman correlation analysis. Descriptive statistics were given as mean ± standard deviation, median (25th-75th percentiles), and frequency (percentage) according to the data structure. Results were considered statistically significant when p-value was <0.05.

Results

A total of 14 kidney transplantations (male/female= 7/7) were performed within one year at our department. Table 1 shows the demographic and intraoperative data of transplanted cases. The mean age of the patients was 39.9 ± 13.3 years (min-max: 21-61 years), and the mean body weight was 62 ± 15.4 kg. Eleven of the donors (78.6%) were provided from the deceased. Among the etiologic causes of 14 ESRD patients who underwent renal transplantation, no primary etiology was detected in 8 (57.1%) of the patients (Figure 1). There were comorbid conditions present in only 5 patients (Table 1). Dialysis was performed in all cases before transplantation. Of the 14 cases, 11 had undergone hemodialysis (HD) and 3 had periton dialysis (PD). None of our patients received preemptive transplantation. Eleven patients were considered as ASA-II and 3 patients as ASA-III. None of the patients experienced difficult intubation. All patients were given desflurane in the maintenance of anesthesia. The mean duration of anesthesia was 242.8 ± 85.2 min. Two arterial catheters, four central venous catheters (CVC) and one hemodialysis catheter were inserted during the operation (Table 1). Intraoperative hypotension was detected in 6 (42.8%) patients. The warm ischemia duration of the organs was 143 ± 20 sec and the total ischemia duration was 720 ± 216 min (min-max= 530-1200 min). In the intraoperative period, 1535 ± 771 ml of 0.9% NaCl was administered as the fluid maintenance.

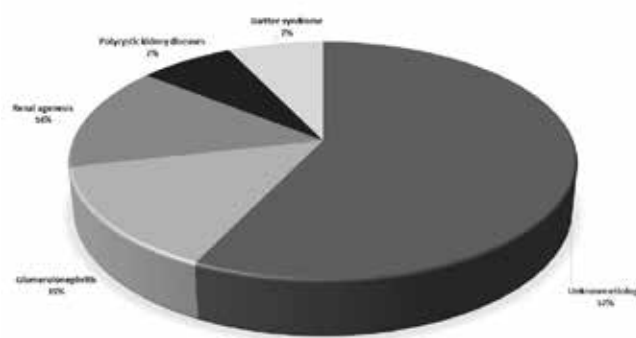


Figure 1. Distribution of RT patients according to ESRD etiology

Table 1. Demographic and intraoperative data of the patients underwent renal transplantation

No	Gender	Age (year)	BW (kg)	Donor	Comorbidity	TIS (min)	AS (min)	IOF (ml)	Hypotension (min)	IOC	Rejection
1	M	29	83	Mother®Son	Asthma	3	270	3000	No	-	-
2	F	21	45	Deceased	No	600	165	2000	5	HD	-
3	M	29	63	Deceased	No	840	220	1000	No	CVC	-
4	F	53	60	Husband®Wife	CVE	2	480	2500	25	-	+
5	M	59	70	Deceased	No	780	210	2000	No	-	-
6	F	22	36	Deceased	CMP	530	240	500	10	AC	-
7	F	35	52	Deceased	No	545	180	1000	No	-	-
8	M	34	72	Wife® Husband	No	2	380	1000	No	-	-
9	M	35	65	Deceased	No	540	210	1000	No	-	-
10	F	47	52	Deceased	MI	545	220	1000	10	AC	-
11	M	55	60	Deceased	DM	600	210	1000	5	-	-
12	F	60	60	Deceased	No	780	210	2500	No	CVC	+
13	F	47	91	Deceased	No	1200	205	1000	No	CVC	-
14	M	35	50	Deceased	No	960	200	2000	5	CVC	-

BW: Body weight; AD: Anesthesia duration; TID: Total ischemia duration; IOF: Intraoperative fluid; IOC: Intraoperative catheter; PCKD: Polycystic kidney disease; CVE: Cerebrovascular event; CMP: Cardiomyopathy; MI: Mitral insufficiency; DM: Diabetes mellitus; HD: Hemodialysis, CVC: Central venous catheter; AC: arterial catheters

nance. The limit values for blood and blood products transfusion were below 7 g/dl for hemoglobin and below 50,000/mm³ for platelet count [5]. However, none of the patients required transfusion. Only 2 patients (14.2%) had intraoperative complications. Only one patient underwent re-intubation due to respiratory depression in a post-anesthesia care unit (PACU) and required mechanical ventilation. A thoracic tube was placed in the second patient due to pneumothorax.

No mortality was observed during the perioperative period. Two of the 14 patients (14.2%) experienced the loss of the transplanted kidney. In the first case, renal vein thrombosis developed due to vascular injury during surgery and the kidney was lost at the postoperative 48th hour. In the other patient, the transplanted kidney was lost due to hyperacute rejection. Currently, 12 patients are being followed up with a functional graft. The mean survival duration of the transplanted organs was 5.5 ± 3.3 months (min-max = 3-11 months).

There was a strong negative correlation between recipient age and organ survival ($r = -0.729$, $p = 0.001$). The survival rate of our patients was 100% while the survival rate of the grafts was 85.8% for the same period.

Discussion

Renal transplantation led to a decrease in mortality and increased the quality of life in ESRD patients. Although the number of patients in the organ waiting list increases every year in our country, the number of patients undergoing RT is still far behind this demand. Turkey's population was 80,810,525 people in 2017 while the number of ESRD patients required RRT was 77,311 people in the same year [1]. A total of 72 centers were capable of RT in Turkey in the year 2017. These centers were university hospitals ($n = 35 - 48.6\%$), hospitals of Health Ministry ($n = 19 - 26.4\%$) and private centers ($n = 18 - 25.0\%$) in decreasing order respectively [1]. In 2017, 2646 (79.3%) of the 3330 RTs were performed from living donors and 684 (20.7%) were from deceased donors [1]. In developed countries, 70-80% of kidney transplantations are reported from a deceased and 20-30% from living donor [6]. In our study, we found that the cadaveric transplantation rate (78.6%) was similar to that in developed countries. We believe that this is a successful out-

come for such an inexperienced center with one-year experience on renal transplantation. This result might be due to the relatively higher awareness of the population living in the Aegean region and the high motivation of the renal transplantation team with cadaveric donors. With the help of the National Transplant and Dialysis Monitoring System in Turkey (TDIs), each transplantation center can load their data to the system. In this way, a scoring system is used in the distribution of cadaver kidneys throughout the country. In this scoring system, tissue type adherence, the age of the patient and the duration of dialysis are taken into con-

sideration. In particular, if the length of the patient's dialysis period increases, the total score increases. In parallel with the prolongation of life expectancy and the increasing prevalence of chronic diseases (such as diabetes mellitus (DM), hypertension (HT)) in our country, the incidence of ESRD and the number of patients in organ waiting lists will increase. So, the number of cadaveric kidney donations should be increased by informing the public, especially health institutions, and raising their awareness about organ donation in various ways.

It is known that preemptive transplantation improves graft function and decreases mortality compared to transplantation in patients undergoing dialysis. However, it has also been reported that if the patient requires dialysis, initiation of dialysis together with scheduled transplantation within six months does not affect organ survival [6-7]. For this reason, the current guidelines recommend that patients should be enrolled in the transplantation list within six months from the estimated date of dialysis initiation [6, 8]. On the other hand, it is observed that the number of transplantation in our country has increased in recent years and this increase is mainly due to the increase in preemptive transplantations (38.4%) [1]. However, it is thought that some cases undergo transplantation prematurely and preemptive transplantation cases are abused [1]. Necessary arrangements should be made to prevent premature preemptive transplantations. None of the patients in our study was a preemptive transplantation case.

While 5-year survival rate is as high as 96% in renal transplantation patients, this rate is quite low in patients undergoing hemodialysis (46%) or peritoneal dialysis (66%) [8]. In our study, the 1-year survival rate of renal transplantation (85.8%) was slightly lower than that reported in the literature. This result might be due to the fact that the center has just started transplantation operations, so has not yet had sufficient experience and most donors had been cadavers. The first of the failed transplantations was risky transplantation from a man to his wife with a total of 6 mismatches. This transplantation, which was risky immunologically, failed after the development of a surgical vascular complication. The other failed transplantation was from a cadaver with three mismatches and resulted from

hyperacute rejection. In order to increase the organ survival in the transplantation, we think that a successful surgical procedure is also critical together with the detailed immunological evaluation during the preparation phase. In the forthcoming years, we aim to increase our organ survival rate by increasing our experience.

According to the records of the Turkish Nephrology Association by the end of 2017, ESRD causes of the patients who underwent renal transplantation were 'unknown etiology' in the first rank (28.5%) [1]. In our study, among the ESRD patients who underwent transplantation, 'unknown etiology' (57.1%) was in the first rank in accordance with our country, but at a higher rate. Comorbid diseases in patients undergoing renal transplantation may affect postoperative organ survival [9]. Cardiovascular diseases are the main causes that determine the postoperative mortality of ESRD patients [10-11]. In our study, since most of our patients were young, the rate of patients with severe comorbidity was not so high. However, there was no mortality developed in our patients. In the pre-transplantation evaluation, we think that the comorbid conditions that would affect survival should be evaluated in detail.

The functions of the graft depend on the condition of the kidney prior to transplantation, cold/warm ischemia durations, and post-transplant graft perfusion [5]. The shorter the cold ischemia time, the better the long-term survival of the graft is [12]. In our study, the duration of cold ischemia was shorter than 24 hours in all cadaveric donors.

In the preoperative evaluation, dialysis modality, the last dialysis time, dry weight and preoperative fluid status (ranging from severe hypovolemia to hypervolemia) should be evaluated in detail. Especially in ESRD patients, the measurement of dry weight and serum potassium levels after dialysis is important in the management of fluid-electrolyte balance during operation [5]. Previous publications have reported that performing dialysis 24 hours prior to transplantation cause delay in graft functions. However, in recent years it has been emphasized that treatment should be managed on a case basis manner [6, 13]. All of our patients underwent dialysis in the pre-transplantation period. We have not experienced such a problem in our diabetic patient.

In the evaluation of intravascular volume during transplantation, central venous pressure (CVP) was recommended to be maintained between 10-15 mmHg [5-6, 14]. In recent years, it has been reported that this is not completely valid and hypovolemia can also be determined by intra-arterial dynamic measurements (pulse pressure, stroke volume variability, etc.). However, many centers still advocate CVC placement necessity. In particular, CVC is widely used for induction therapy [6, 15]. In our study, CVC was placed in only 4 cases. In addition, arterial catheterization was performed in two of our patients who had been undergoing hemodialysis and had had cardiac problems. Arterial catheterization is not recommended in patients who may need fistula during the post-transplantation period. Therefore, we believe that invasive catheterization procedures should be decided for each patient individually as stated in the literature. Appropriate intraoperative fluid management is independently associated with renal functions after transplantation. For this reason, kidney transplantation should be performed with adequate-moderately perfused kidney under an ideal mean arterial blood pressure (10-20% above or below the basal value). In this way, hypotension during organ reperfusion can be avoided [5]. On the other hand, excessive fluid administration may lead to

fluid overload, particularly in patients with cardiac problems. Classically, after exclusion of cardiac problems, giving a total of 30-40 ml/kg of 0.9% sodium chloride fluid intraoperatively during transplantation is recommended. Balanced salt solutions are reported to be safely used in ESRD patients with a mild increase in lactate levels without changing serum potassium levels [5, 16-17]. In our study, the recommended volume of 0.9% NaCl treatment was administered to the patients except for those with cardiac problems.

In most of our patients, antihypertensive treatments were discontinued before the operation. However, we had taken precautions for refractory hypotension after anesthesia induction in very few patients who had taken their medication. Despite these measures, intraoperative hypotension developed in 6 patients. In patients with suspected hypovolemia, fluid boluses were rapidly administered and their fluid status was monitored closely during the perioperative period.

Limitations

The most important limitation of the study was the small number of sample size. However, we hope to reach an increased number of cases in the following years by increasing the experience of our center and the number of live donors. Besides, the retrospective design of the study was another limitation.

Conclusion

Management of renal transplantation is a serious job which requires team cooperation, and it can favorably change the patient's life quality when it results successfully. In renal transplantation, achieving the post-transplantation survival rate (90-96%) reported in the literature requires a detailed preoperative evaluation of patient along with appropriate intraoperative fluid administration and hemodynamic control.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: None

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

References

- Süleymanlar G, Ateş K, Seyahi N, editors. Registry of the nephrology, dialysis and transplantation in Turkey 2017. Ankara: Miki Matbaacılık San ve Tic. Ltd. Şti.; 2018. p.1-132.
- Wray CL. Advances in the Anesthetic Management of Solid Organ Transplantation. *Adv Anesth.* 2017;35:95-117. DOI: 10.1016/j.aan.2017.07.005.
- Cillimoğlu AÖ, Yılmaz S, Oğurlu M. Adnan Menderes Üniversitesi Hastanesi Personelinin Organ-Doku Bağışı ve Nakli Hakkındaki Bilgi ve Düşünceleri (The Knowledge and Thoughts of Medical Staff at Adnan Menderes University Hospital About Organ-Tissue Donation and Transplantation). *Turk Neph Dial Transpl* 2016;25:254-62. DOI: 10.5262/tndt.2016.1003.07
- Mark JB, Steele SM. Cardiovascular effects of spinal anesthesia. *Int Anesthesiol Clin* 1989; 27:31-9.
- Robertson E, Logan N, Pace N. Anaesthesia for renal transplantation. *Anaesthesia and intensive care medicine* 2018: 552-6. DOI:https://doi.org/10.1016/j.mpaic.2018.08.012
- Mittel AM, Wagener G. Anesthesia for Kidney and Pancreas Transplantation. *Anesthesiol Clin.* 2017;35:439-52. DOI: 10.1016/j.anclin.2017.04.005.
- Goldfarb-Rumyantzev A, Hurdle JF, Scandling J, Scandling J, Wang Z, Baird B, et al. Duration of end-stage renal disease and kidney transplant outcome. *Nephrol*

Dial Transplant 2005; 20:167–75.

8. UK renal registry 19th annual report e 2016. Nephron. 2017; 137(1): 11–40.

9. Badve S, Roberts M, Hawley CM, Cass A, Garg AX, Krum H, et al. Effects of beta-adrenergic antagonists in patients with chronic kidney disease. A systematic review and meta-analysis. J Am Coll Cardiol. 2011; 58: 1152–61. DOI: 10.1016/j.jacc.2011.04.041.

10. Pilmore H, Ent H, Chang S, McDonald SP, Chadban SJ. Reduction in cardiovascular death after kidney transplantation. Transplantation. 2010; 89: 851–7. DOI: 10.1097/TP.0b013e3181caeead.

11. Herzog CA, Asinger RW, Berger AK, Charytan DM, Díez J, Hart RG, et al. Cardiovascular disease in chronic kidney disease. A clinical update from Kidney Disease: improving Global Outcomes (KDIGO). Kidney Int. 2011; 80: 572–86. DOI: 10.1038/ki.2011.223

12. Helfer MS, Pompeo JC, Costa ORS, Vicari AR, Ribeiro AR, Manfro RC. Long-term effects of delayed graft function duration on function and survival of deceased donor kidney transplants. J Bras Nefrol. 2018. DOI: 10.1590/2175-8239-jbn-2018-0065.

13. Kikic Z, Lorenz M, Sunder-Plassmann G, Schillinger M, Regele H, Györi G, et al. Effect of hemodialysis before transplant surgery on renal allograft function—a pair of randomized controlled trials. Transplantation. 2009; 88: 1377–85. DOI: 10.1097/TP.0b013e3181bc03ab.

14. Marik PE, Cavallazzi R. Does the central venous pressure predict fluid responsiveness? An updated meta-analysis and a plea for some common sense. Crit Care Med. 2013;41(7):1774–81. DOI: 10.1097/CCM.0b013e31828a25fd.

15. Durairaj L, Schmidt GA. Fluid therapy in resuscitated sepsis: less is more. Chest. 2008; 133: 252–63. DOI: 10.1378/chest.07-1496.

16. Hadimioglu N, Saadawy I, Saglam T, Ertug Z, Dinckan A. The effect of different crystalloid solutions on acid-base balance and early kidney function after kidney transplantation. Anaesth Analg. 2008; 107: 264–9. DOI: 10.1213/ane.0b013e3181732d64

17. O'Malley CM, Frumento RJ, Hardy MA, Benvenisty AI, Brentjens TE, Mercer JS. A randomised, double-blind comparison of Lactated Ringer's Solution and 0.9% NaCl during renal transplantation. Anaesth Analg. 2005; 100: 1518–24.

How to cite this article:

Yılmaz S, Erel KV. Anesthesiology experience with patients underwent renal transplantation at a university hospital: first-year results. Ann Clin Anal Med 2020;11(2): 150-154